DENSO

Diesel Injection Pump

SERVICE MANUAL

COMMON RAIL SYSTEM (CRS)
FOR ISUZU 6DE1 ENGINE

OPERATION

April, 2006

DENSO CORPORATION

00400558E

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1. PRODUCT APPLICATION INFORMATION

1.1 Outline

- The Common Rail System (CRS) used for the ISUZU 6DE1 engine in the RENAULT/OPEL has been redesigned to comply with EURO 4 emission regulations. The details of the CRS described herein are basically the same as those in the service bulletin entitled, "S/B Code: ECD 02-07, Subject: Common Rail System (ECD-U2P) for ISUZU Engine", issued in May, 2003. The two major points that have changed for this system are the addition of a Diesel Particulate Filter (DPF) system, and injectors equipped with the QR codes. This service bulletin describes change items only. Use this bulletin in conjunction with the S/B Code: ECD 02-07 service bulletin mentioned above.

1.2 Application

Manufacturer Name	Model Name	Engine	Destination	Release for Sale
RENAULT	Vel Satis	6DE1	Europe	November, 2005
	Espace			–
OPEL	Signum			–

1.3 System Component Part Numbers

For RENAULT

Parts Name	DENSO Parts Number	Manufacturer Parts Number	Remarks
Cylinder recognition sensor	949979-156#	897353105#	
Crankshaft position sensor	949979-120#	'897321620#	
Rail	095440-072#	897353063#	
EDU	131000-146#	897353189#	
Engine ECU	275800-387#	897353186#	Vel Satis
	275800-389#	897353501#	Espace
	275800-388#	897353502#	Espace
Injector	095000-583#	897353080#	
Supply pump	097300-002#	897228919#	HP2 type

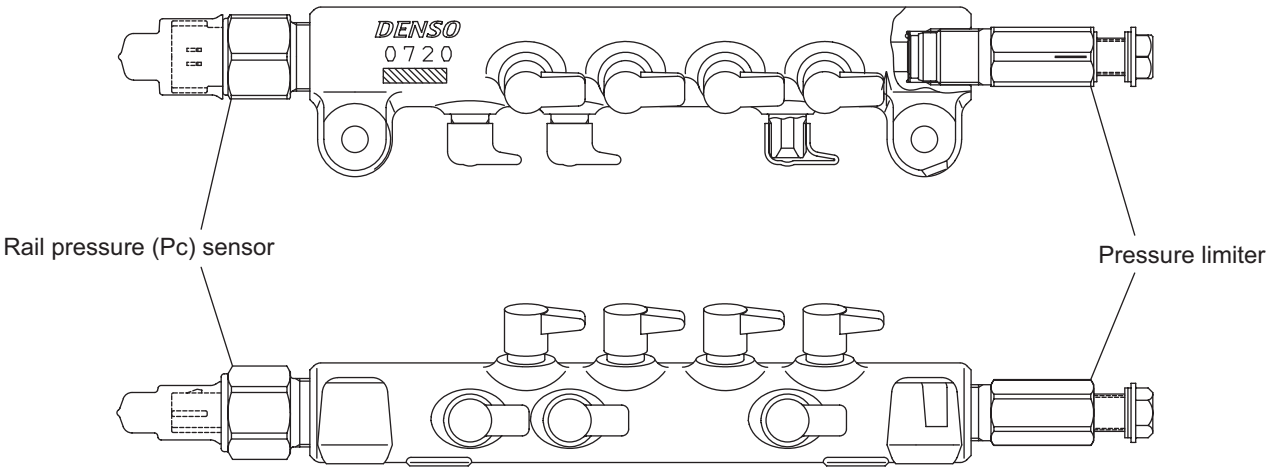
For OPEL

Parts Name	DENSO Parts Number	Manufacturer Parts Number	Remarks
Cylinder recognition sensor	949979-156#	897353105#	
Crankshaft position sensor	949979-120#	'897321620#	
Rail	095440-072#	897353063#	
EDU	131000-145#	897353040#	
Engine ECU	275800-391#	897353188#	MT
	275800-392#	'897379557#	AT
	275800-393#	898009250#	Spare parts
Injector	095000-583#	897353080#	
Supply pump	097300-002#	897228919#	HP2 type

2. RAIL

2.1 Outline

- The overall shape of the rail has been changed. In addition, the rail pressure sensor and pressure limiter have been modified.



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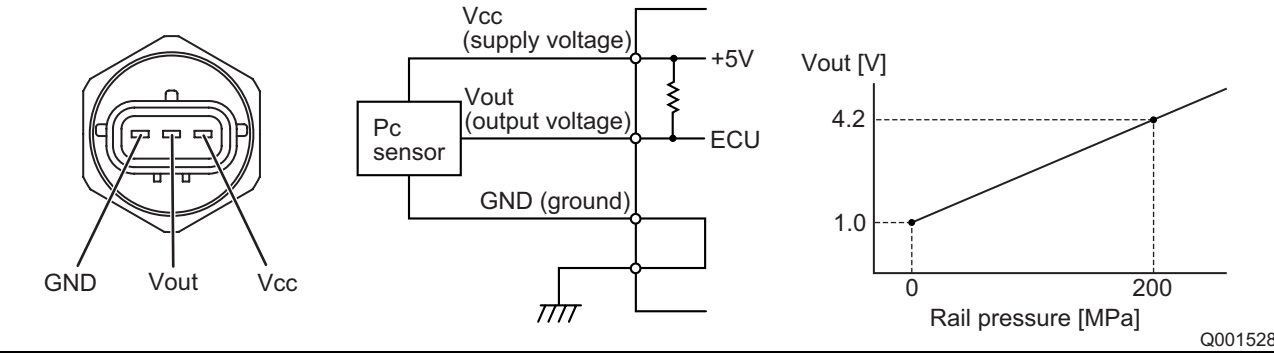
2.2 Rail Pressure (Pc) Sensor

- The shape of the rail pressure sensor terminals and sensor output characteristics have been changed.



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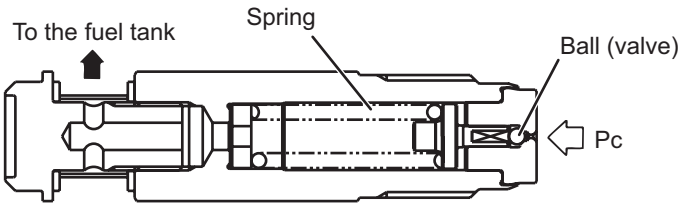
2.3 Pressure Limiter

- The pressure limiter closing pressure has been changed from 171MPa to 181MPa.



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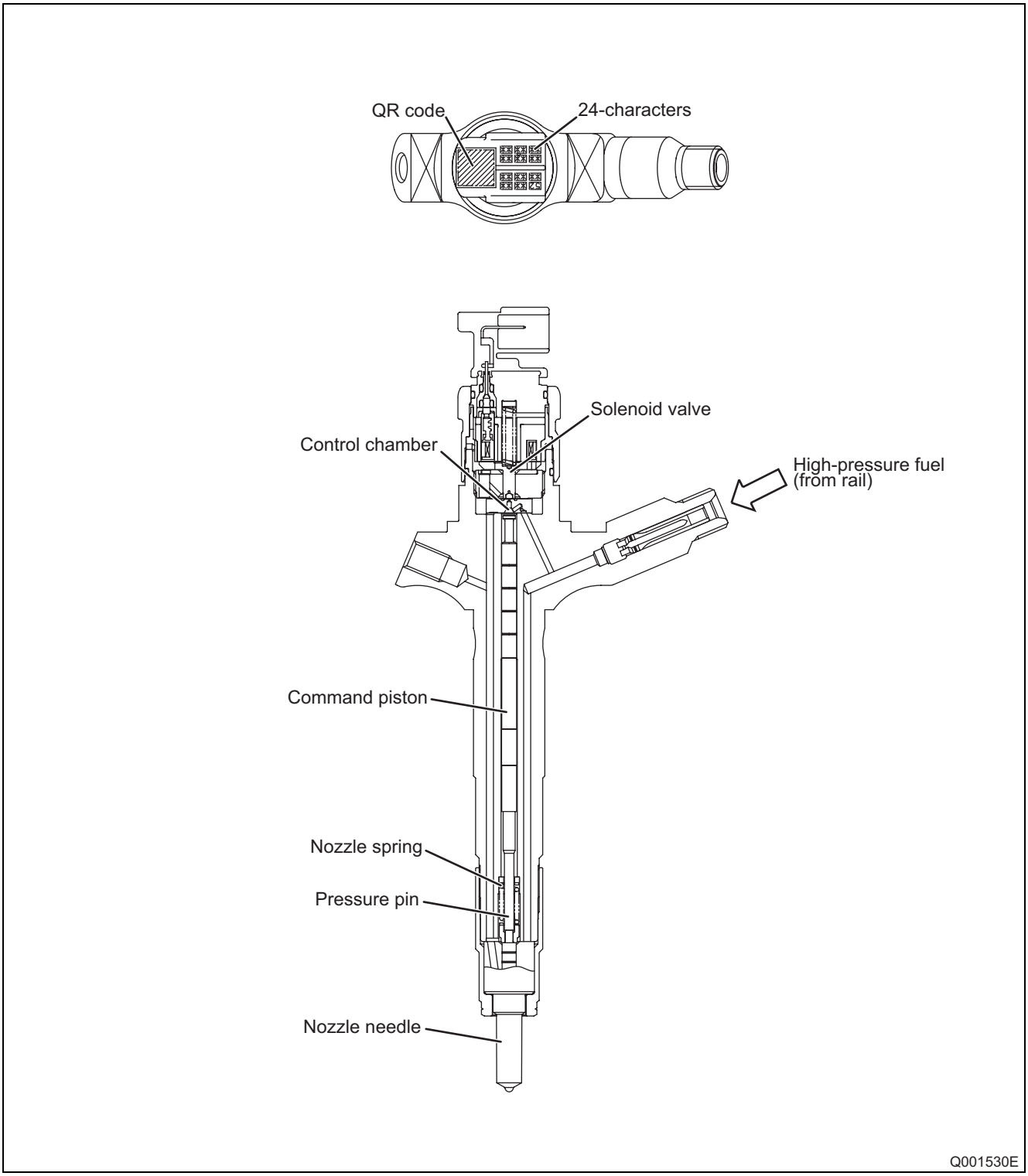
3. INJECTORS

3.1 Outline

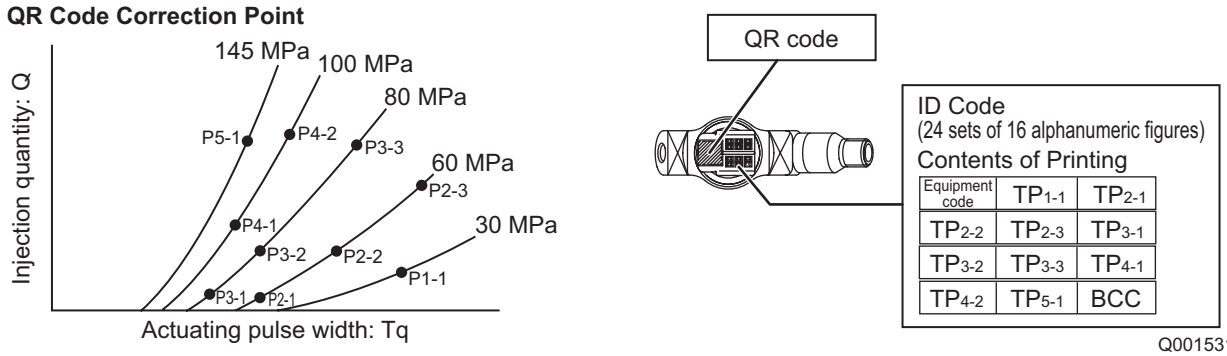
- The X2 type injectors used previously have been changed to the G2 type, and now employ QR codes. Injector operation has not changed. For details on operation, refer to the service bulletin entitled, "S/B Code: ECD 02-07, Subject: Common Rail System (ECD-U2P) for ISUZU Engine", starting on page 16.

Construction



3.2 QR Code

- QR (Quick Response) codes have been adopted to enhance the injection quantity precision of the injectors. The adoption of QR codes minimizes injection quantity deviation control throughout all pressure ranges, improving combustion efficiency, reducing emissions, etc.

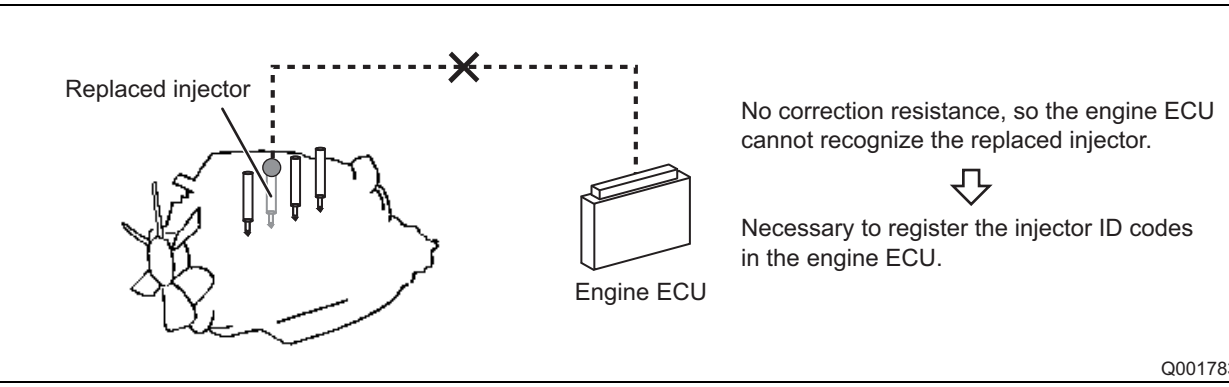


3.3 Handling Injectors with QR Codes (Reference)

- Injectors with QR codes have the engine ECU recognize and correct the injectors, so when an injector or the engine ECU is replaced, it is necessary to register the injector's ID code in the engine ECU.

(1) Replacing the Injector

• It is necessary to register the ID code of the injector that has been replaced in the engine ECU.


Replaced injector
Engine ECU
No correction resistance, so the engine ECU cannot recognize the replaced injector.
Necessary to register the injector ID codes in the engine ECU.
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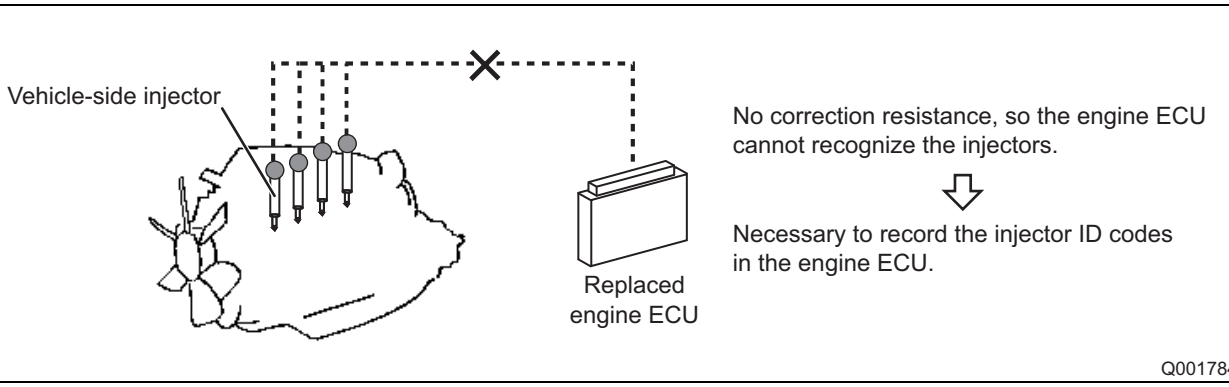
(2) Replacing the Engine ECU

• It is necessary to register the ID codes of all the vehicle injectors in the replaced engine ECU.


Vehicle-side injector
Replaced engine ECU
No correction resistance, so the engine ECU cannot recognize the injectors.
Necessary to record the injector ID codes in the engine ECU.
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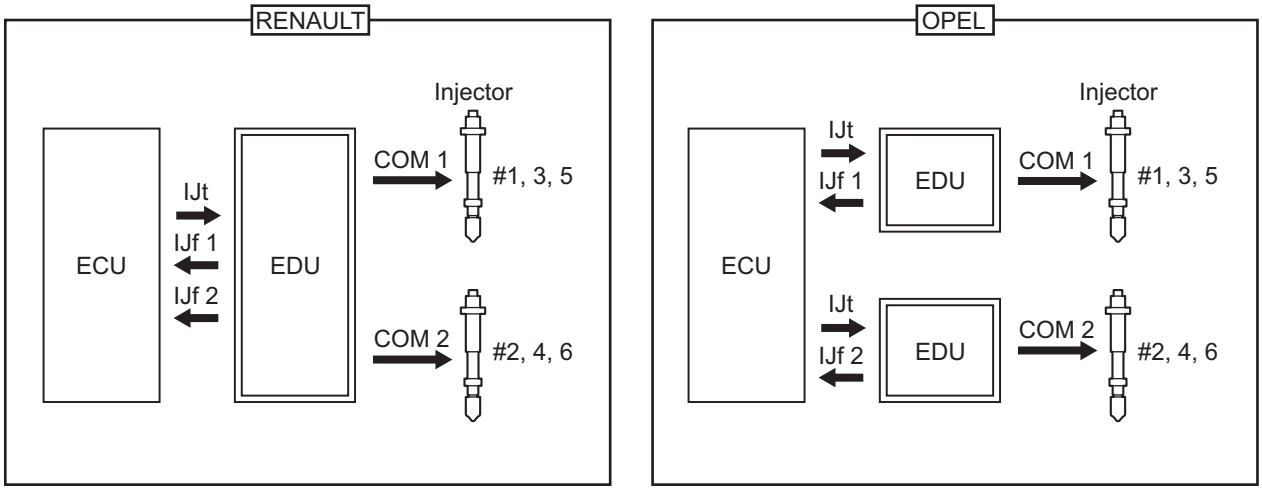
4. ELECTRONIC DRIVING UNIT (EDU)

4.1 Outline

- The injector actuation circuit has been changed to include two systems. The EDU in the RENAULT actuation circuit has been changed to include two outputs, while the OPEL actuation circuit has been changed to include two EDUs.In accordance with these changes, there are now two injection verification signals. Actuation for Injectors 1,3, and 5 is via COM1, with the corresponding verification signal transmitted via IJF1. Actuation for injectors 2,4, and 6 is via COM2, with the corresponding verification signal transmitted via IJF2. All remaining terminals have not been changed. For details on terminals other than those mentioned above, refer to the service bulletin entitled, "S/B Code: ECD 02-07, Subject: Common Rail System (ECD-U2P) for ISUZU Engine", starting on page 16.

[Schematic Diagram]



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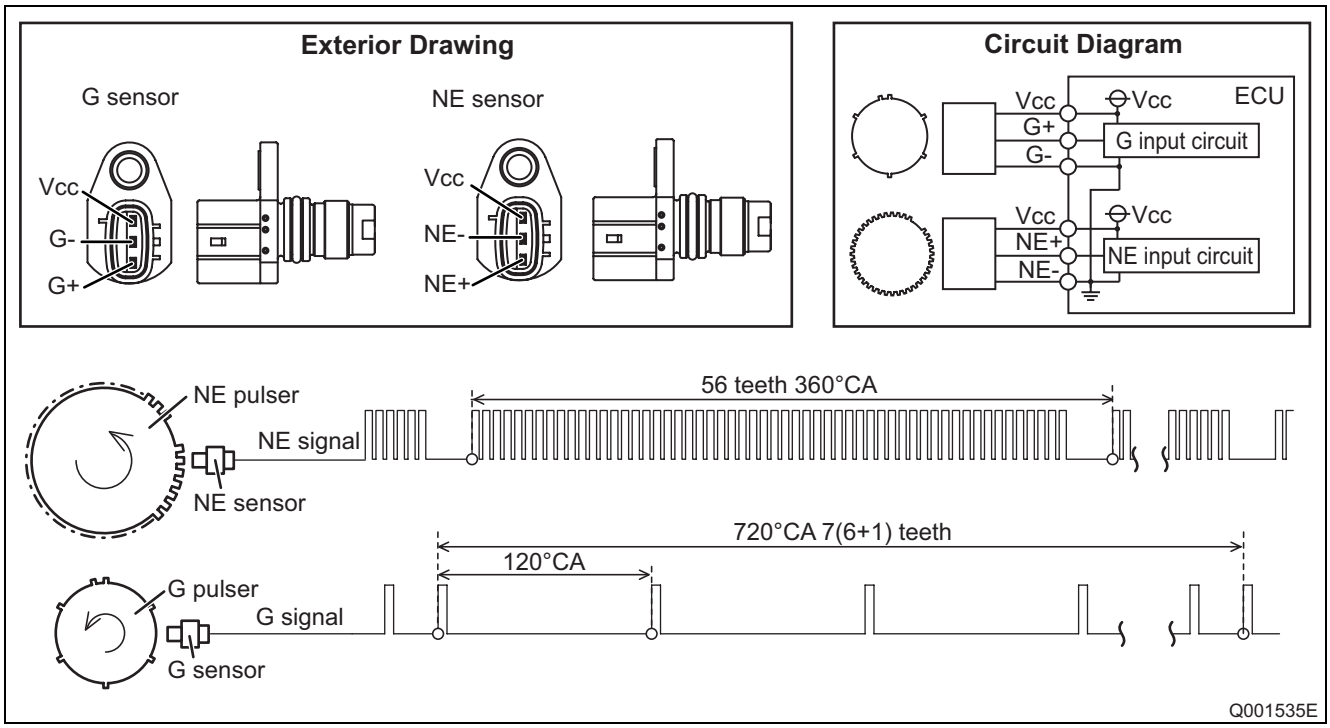
5. DESCRIPTION OF SENSORS

5.1 Crankshaft Position Sensor (NE Sensor) and Cylinder Recognition Sensor (G Sensor)

- The NE sensor has been changed from a Magnetic Pickup (MPU) type to a Magnetic Resistance Element (MRE) type. In addition the number of pulse-gear teeth has been changed to equal 56 pulses (four missing teeth) for every 360 °CA.
- The crank position sensor has also been changed to a Magnetic Resistance Element (MRE) type. The number of teeth has not changed.



6. CONTROL SYSTEMS

6.1 Control System

Name	Function
Fuel injection system	Calculates and controls the optimal injection rate, injection duration, and injection pressure according to engine status.
ISC	Controls engine idle speed according to the coolant temperature and accessory load so on.
EGR	Controls the EGR ratio according to the engine condition.
Turbo	Controls the turbo revolutions according to the engine condition.
Intake throttle (*2)	Controls the intake air according to the engine condition.
A/C	Controls the operation of air conditioner (A/C enable or disable).
Fan	Controls fan operation (fan speed control, after fan control).
Diagnosis	Detects vehicle system malfunctions (sensors, actuators, and systems). Turns on dashboard warning lamp to warn the driver when ECU failure is detected.
Intake shutter (*1)	Shuts off the intake air when the ignition switch is turned off.
Cruise control	Controls the vehicle speed according to the driver request.
DPF system (*2)	PM (Particulate Matter) reduction

*1: RENAULT *2: OPEL

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6.2 Actuator System

Name	Function	Fuel Injection	Rail Pressure	ISC	EGR	Turbo	Intake	VSS	Intake Shutter (*1)	DPF (*2)
Main relay	Supplies battery voltage to all engine control systems.	○	○	○	○	○	○	○	○	○
Injector	Controls fuel injection quantity and injection timing.	○								
Suction control valve	Controls the volume of fuel flowing to the supply pump.		○							
EGRV DC-motor	Controls EGR valve lift.				○					
Turbo controller	Controls turbo position.					○				
VSV (Valuable Swirl Control)	Controls the valuable swirl control valve position. (open or closed)							○		
Glow controller	Controls the current supply to the glow plugs.									○
Relays (A/C, fan, etc.)	Controls function operations.			○						
VSV for Intake shutter (*1)	Controls the intake shutter angle. (open or closed)								○	
Intake throttle (ITHR) DC-motor (*2)	Controls the intake throttle angle.						○			

*1: RENAULT *2: OPEL

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6.3 Sensor System

Name	Function	Fuel Injection	Rail Pressure	ISC	EGR	Turbo	VSS	Intake Shutter (*1)	Intake Throttle (*2)	DPF (*2)
Crankshaft position (NE)	Measures engine speed and crank angle position.	○	○	○	○	○	○	○	○	○
Cylinder recognition (TDC)	Measures cylinder discrimination.	○	○	○	○	○	○	○	○	○
Accelerator position	Measures accelerator pedal position.	○		○	○	○				
Rail pressure	Measures fuel pressure inside the rail.	○	○							
Mass airflow	Measures intake airflow using a hot wire.	○			○	○				
Coolant temperature	Measures engine coolant temperature.	○	○	○	○	○	○	○	○	○
Intake air temperature	Measures intake manifold air temperature.	○			○	○				
Fuel temperature	Measures fuel temperature on the injector return line.	○	○							
Turbo pressure	Measures intake manifold pressure.	○				○				
Atmospheric air pressure	Measures atmospheric pressure.	○		○	○	○				
EGR lift position	Measures EGR valve lift position.				○					
Turbo position (CAN)	Measures turbo controller position.					○				
Starter signal	Measures starter motor operation.	○	○	○	○	○				
Atmospheric temperature	Measures atmospheric temperature.	○			○	○			○	○
Oil temperature	Measures oil temperature.	○	○		○	○			○	○
A/C pressure	Measures A/C gas pressure.			○						
Swirl control (VSS) limit switch	Measures intake shutter position.						○			
Intake throttle position (*2)	Measures intake throttle position.								○	
Exhaust gas temperature 1 (*2)	Measures pre catalyst down stream temperature.	○								○
Exhaust gas temperature 2 (*2)	Measures diesel particulate filter (DPF) temperature.	○								○
DPF pressure (*2)	Measures DPF pressure.									○

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*1: RENAULT *2: OPEL

7. DIAGNOSIS

7.1 DTC (Diagnostic Trouble Code) Table

● Read symptom codes using the manufacturer's diagnostic tool.

(1) For RENAULT

DTC	Failure Part	Symptom	Failure Mode
P0100	Mass air flow sensor	03	Mass air flow sensor signal too high
		14	Mass air flow sensor signal too low
		06	Mass air flow sensor performance invalid
P0110	Intake air temperature sensor	15	Intake air temperature sensor signal too high
		02	Intake air temperature sensor signal too low
P0115	Coolant temperature sensor	15	Coolant temperature sensor signal too high
		02	Coolant temperature sensor signal too low
		06	Coolant temperature sensor performance invalid
P0225	Accelerator position sensor	03	Accelerator position sensor No.1 signal too high
		14	Accelerator position sensor No.1 signal too low
		06	Accelerator position sensor signal performance invalid
P2120		03	Accelerator position sensor No.2 signal too high
		14	Accelerator position sensor No.2 signal too low
P0235	Turbo pressure sensor	03	Turbo pressure sensor signal too high
		14	Turbo pressure sensor signal too low
		06	Turbo pressure sensor performance invalid
P0180	Fuel temperature sensor	15	Fuel temperature sensor signal too high
		02	Fuel temperature sensor signal too low
P0190	Rail pressure sensor	15	Rail pressure sensor signal too high
		02	Rail pressure sensor signal too low
		0C	Rail pressure sensor signal stuck in the middle range
P0195	Oil temperature sensor	15	Oil temperature sensor signal too high
		02	Oil temperature sensor signal too low
P0409	EGR lift (position) sensor	03	EGR lift (position) sensor signal too high
		14	EGR lift (position) sensor signal too low
P2226	Atmospheric pressure sensor	03	Atmospheric pressure sensor signal too high
		14	Atmospheric pressure sensor signal too low
P2146	Injector/EDU	06	Injector fail pattern is not confirmed. (Multi injection is NG, single injection is OK.)
P0070	Ambient temperature sensor	15	Ambient temperature sensor signal too high
		02	Ambient temperature sensor signal too low
–	Intake throttle sensor	00	Intake throttle lift (position) sensor signal too high
		00	Intake throttle lift (position) sensor signal too low

DTC	Failure Part	Symptom	Failure Mode
P0512	Starter switch	03	Starter switch short to battery
		14	Starter switch open/short to GND
P0335	Crankshaft position sensor	07	Crankshaft position sensor no pulse
		06	Crankshaft position sensor signal invalid
P0340	Cylinder recognition sensor	07	Cylinder recognition sensor no pulse
		06	Cylinder recognition sensor signal invalid
P0016	Crankshaft position sensor/ Cylinder recognition sensor	06	Crankshaft position sensor/cylinder recognition sensor signal synchronization error
P0560	Battery voltage	09	Battery voltage too high
		08	Battery voltage too low
–		00	Battery voltage unstable malfunction
P0685	Main relay	0B	Main relay diagnostics; main relay stuck closed
		0A	Main relay diagnostics; main relay stuck open/relay output open load
P0641	Reference voltage1	09	Analog sensor reference voltage output No.1 too high
		08	Analog sensor reference voltage output No.1 too low
P0651	Reference voltage2	09	Analog sensor reference voltage output No.2 too high
		08	Analog sensor reference voltage output No.2 too low
P0380	Glow system	15	Glow plug R side open load short, glow diagnosis line open load/short to battery, glow controller internal malfunction
		02	Glow controller diagnosis line 1 short to GND
P0382		15	Glow plug R side open load short, glow diagnosis line open load/short to battery, glow controller internal malfunction
		02	Glow controller diagnosis line 2 short to GND
P0697	Reference voltage3	09	Analog sensor reference voltage output No.3 too high
		08	Analog sensor reference voltage output No.3 too low
P0660	Swirl control output (VSV)	03	Swirl control output (VSV) short to battery
		14	Swirl control output (VSV) open load/short to GND
P0403	EGR control DC motor	0C	EGR DC motor output 1 short to battery/short GND, output 2 short to battery/short GND, or motor short
		01	EGR DC motor output 1 open load, output 2 open load/, or motor open load
P0201	Injector 1	03	Injector 1 output short to GND (with resistance), short to battery (injection pulse<0.7ms), coil short; EDU malfunction
		14	Injector 1 output open load, short to GND (without resistance), coil open load; IJT1 open/short to GND, or EDU malfunction
P0202	Injector 2	03	Injector 2 output short to GND (with resistance), short to battery (injection pulse<0.7ms), coil short; EDU malfunction
		14	Injector 2 output open load, short to GND (without resistance), coil open load; IJT2 open/short to GND, or EDU malfunction
P0203	Injector 3	03	Injector 3 output short to GND (with resistance), short to battery (injection pulse<0.7ms), coil short; EDU malfunction
		14	Injector 3 output open load, short to GND (without resistance), coil open load; IJT3 open/short to GND, or EDU malfunction

DTC	Failure Part	Symptom	Failure Mode
P0204	Injector 4	03	Injector 4 output short to GND (with resistance), short to battery (injection pulse<0.7ms), coil short; EDU malfunction
		14	Injector 4 output open load, short to GND (without resistance), coil open load; IJT4 open/short to GND, or EDU malfunction
P0205	Injector 5	03	Injector 5 output short to GND (with resistance), short to battery (injection pulse<0.7ms), coil short; EDU malfunction
		14	Injector 5 output open load, short to GND (without resistance), coil open load; IJT5 open/short to GND, or EDU malfunction
P0206	Injector 6	03	Injector 6 output short to GND (with resistance), short to battery (injection pulse<0.7ms), coil short; EDU malfunction
		14	Injector 6 output open load, short to GND (without resistance), coil open load; IJT6 open/short to GND, or EDU malfunction
P062D	Injector drive1	0C	Injector 1, 3, or 5 output short to battery (when injection pulse>0.7ms)/short to GND (failure occurred when EDU power was OFF); IJT1, 3, or 5 output short to battery; IJF1 output short to GND; COM1 open load/short to GND (failure occurred when EDU power was OFF), COM1 short to battery, or EDU malfunction
		06	Injector 1, 3, or 5 output short to GND (failure occurred when EDU power was ON); IJF1 output short to battery/open load; COM1 open load/short to GND (failure occurred when EDU power was ON), EDU malfunction
P062E	Injector drive2	0C	Injector 2, 4, or 6 output short to battery (when injection pulse>0.7ms)/short to GND (failure occurred when EDU power was OFF); IJT2, 4, or 6 output short to battery; IJF2 output short to GND; COM2 open load/short to GND (failure occurred when EDU power was OFF), COM2 short to battery, or EDU malfunction
		06	Injector 2, 4, or 6 output short to GND (failure occurred when EDU power was ON); IJF2 output short to battery/open load; COM2 open load/short to GND (failure occurred when EDU power was ON), EDU malfunction
P2146	EDU	12	EDU battery open load/short to GND, EDU GND open load/short to battery, EDU malfunction
	Injector/EDU	0D	Unknown failure pattern, EDU malfunction
P0611	QR code	16	QR code not programmed
		0D	QR code ERROR
		06	QR correction information is abnormal
P0230	Pump SCV	03	SCV COM short to battery; SCV1, 2 output short to battery
		06	SCV COM short to GND/open load; SCV1, 2 (COM side) short to GND; unknown SCV failure
		14	SCV1, 2 output open load/short to GND; SCV1, 2 coil open
		0C	SCV1, 2 coil short
P0190	Rail system	06	Rail pressure sensor performance invalid included fuel leak
P0088	Rail pressure sensor	09	Rail pressure exceeds upper limit
P0093	Rail pressure limiter	05	Pressure limiter activated
P0217	Engine overheat	09	Engine overheat
P0219	Engine overrun	09	Engine overrun

DTC	Failure Part	Symptom	Failure Mode
P0606	Engine ECU internal failure	16	Check sum error-flash area
		0D	CPU fault; main CPU fault
		06	CPU fault; watchdog IC fault
P0301	Injector 1	13	Cylinder 1 fuel system failure
P0302	Injector 2	13	Cylinder 2 fuel system failure
P0303	Injector 3	13	Cylinder 3 fuel system failure
P0304	Injector 4	13	Cylinder 4 fuel system failure
P0305	Injector 5	13	Cylinder 5 fuel system failure
P0306	Injector 6	13	Cylinder 6 fuel system failure
P0402	EGR system	09	EGR excessive flow (EGR positive deviation)
P0401		08	EGR insufficient flow (EGR negative deviation)
P0401	EGR valve	04	EGR valve close stuck
P2263	Turbo system	08	Turbo control system (negative deviation)
		09	Turbo control system (positive deviation)
P0243	Turbo unit	07	CAN2 turbo unit absent
		0E	Turbo unit failure
P0402	EGR valve	05	EGR valve open stuck
P0660	Swirl control position switch	08	Swirl control flap remains closed
		09	Swirl control flap remains open
P0663		08	Swirl control flap remains closed
		09	Swirl control flap remains open
P0403	EGR DC motor	0B	EGR DC motor lock
P0480	Fan relay 1 output	03	Fan control relay 1 short to battery
		14	Fan control relay 1 open load/short to GND
P0481	Fan relay 2 output	03	Fan control relay 2 short to battery
		14	Fan control relay 2 open load/short to GND
P1641	Thermo plunger relay 1 output	03	Thermo plunger relay 1 short to battery
		14	Thermo plunger relay 1 open load/short to GND
P1642	Thermo plunger relay 2 output	03	Thermo plunger relay 2 short to battery
		14	Thermo plunger relay 2 open load/short to GND
P1643	Thermo plunger relay 3 output	03	Thermo plunger relay 3 short to battery
		14	Thermo plunger relay 3 open load/short to GND
–	Intake throttle	00	Intake throttle close stuck
–		00	Intake throttle open stuck
P0235	Variable nozzle turbo	0A	Variable nozzle turbo valve stuck closed
		0B	Variable nozzle turbo valve stuck open
P0243	Turbo unit	16	Turbo unit failure2
P0575	VIF (Vehicle Integrated Function) related diagnosis	80	One of the two brake contacts
		81	Both brake contacts
		82	Cruise analog switch malfunction
		83	Cruise main switch malfunction

DTC	Failure Part	Symptom	Failure Mode
U0101	CAN data error	0E	CAN frame absent AGB (Automatic Gear Box)
U0121		0E	CAN frame absent ESP (Electronic Stability Program)
–	EGR	00	EGR over temperature
P2100	Intake throttle control VSV	03	Intake shutter control VSV short to battery
		14	Intake shutter control VSV open load/short to GND
P0409	EGR valve	06	EGR lift sensor characteristic abnormality (learning value fault)
P0100	Mass air flow sensor	0A	Mass air flow sensor too low (keep output voltage)
P2263	Popping-off	0A	Variable nozzle turbo hose popping off
P0482	Fan relay 3	03	Fan control relay 3 short to battery
		14	Fan control relay 3 open load/short to GND

(2) For OPEL

DTC	Failure Part	Symptom	Failure Mode
P0100	Mass air flow sensor	07	Mass air flow sensor signal too high
		03	Mass air flow sensor signal too low
		52	Mass air flow sensor performance invalid
P0110	Intake air temperature sensor	07	Intake air temperature sensor signal too high
		03	Intake air temperature sensor signal too low
P0115	Coolant temperature sensor	07	Coolant temperature sensor signal too high
		03	Coolant temperature sensor signal too low
		52	Coolant temperature sensor performance invalid
P1120	Accelerator position sensor 1	07	Accelerator position sensor No.1 signal too high
		03	Accelerator position sensor No.1 signal too low
	Accelerator position sensor performance	52	Accelerator position sensor signal performance invalid
P1122	Accelerator position sensor 2	07	Accelerator position sensor No.2 signal too high
		03	Accelerator position sensor No.2 signal too low
P0105	Turbo pressure sensor	07	Turbo pressure sensor signal too high
		03	Turbo pressure sensor signal too low
		52	Turbo pressure sensor performance invalid
P0180	Fuel temperature sensor	07	Fuel temperature sensor signal too high
		03	Fuel temperature sensor signal too low
P0190	Rail pressure sensor	07	Rail pressure sensor signal too high
		03	Rail pressure sensor signal too low
		52	Rail pressure sensor signal stuck in the middle range
P0195	Oil temperature sensor	07	Oil temperature sensor signal too high
		03	Oil temperature sensor signal too low
P0409	EGR lift (position) sensor	07	EGR lift (position) sensor signal too high
		03	EGR lift (position) sensor signal too low
P1105	Atmospheric pressure sensor	07	Atmospheric pressure sensor signal too high
		03	Atmospheric pressure sensor signal too low
P1216	Injector 1-6	50	Injector fail pattern is not confirmed. (multi injection is NG, single injection is OK.)
P1070	Ambient temperature sensor	07	Ambient temperature sensor signal too high
		03	Ambient temperature sensor signal too low
P0638	Intake throttle sensor	07	Intake throttle lift (position) sensor signal too high
		03	Intake throttle lift (position) sensor signal too low
P0335	Crankshaft position sensor	29	Crankshaft position sensor no pulse
		2C	Crankshaft position sensor signal invalid
P0340	Cylinder recognition sensor	29	Cylinder recognition sensor no pulse
		2C	Cylinder recognition sensor signal invalid
P0016	Crankshaft position/cylinder recognition	2B	Crankshaft position sensor/cylinder recognition sensor signal synchronization error

DTC	Failure Part	Symptom	Failure Mode
P0560	Battery voltage	07	Battery voltage too high
		03	Battery voltage too low
		52	Battery voltage unstable malfunction
P1625	Main relay	63	Main relay diagnostics; main relay stuck closed
		0A	Main relay diagnostics; main relay stuck open/relay output open load
P1620	Reference voltage1	07	Analog sensor reference voltage output No. 1 too high
		03	Analog sensor reference voltage output No. 1 too low
P1635	Reference voltage2	07	Analog sensor reference voltage output No. 2 too high
		03	Analog sensor reference voltage output No. 2 too low
P0380	Glow system	05	Glow plug R side open load/short, glow diagnosis line 1 open load/short to battery, glow controller internal malfunction
		02	Glow controller diagnosis line 1 short to GND
P0382		05	Glow plug L side open load/short, glow diagnosis line 2 open load/short to battery, glow controller internal malfunction
		02	Glow controller diagnosis line 2 short to GND
P0381	Glow controller	01	Glow controller command line short to battery; glow controller internal malfunction
		06	Glow controller command line open load/short to GND; glow controller internal malfunction
P1639	Reference voltage3	07	Analog sensor reference voltage output No.3 too high
		03	Analog sensor reference voltage output No.3 too low
P1625	Main relay	01	Main relay/relay output short to battery
		02	Main relay/relay output short to GND
P1243	Swirl control output (VSV)	01	Swirl control output (VSV) short to battery
		06	Swirl control output (VSV) open load/short to GND
P0403	EGR control DC motor	10	EGR DC motor output 1, 2 short to battery/short to GND; motor short
		04	EGR DC motor output 1, 2 open load; motor open load
P0638	Intake throttle control DC motor	10	Intake throttle DC motor output 1, 2 short to battery/short to GND; motor short
		04	Intake throttle DC motor output 1, 2 open load; motor open load
P1291	Injector 1	01	Injector 1 output short to GND (with resistance), short to battery (injection pulse<0.7ms), coil short; EDU malfunction
		04	Injector 1 output open load, short to GND (without resistance), open load; IJT1 open/short to GND, EDU malfunction
P1292	Injector 2	01	Injector 2 output short to GND (with resistance), short to battery (injection pulse<0.7ms), coil short; EDU malfunction
		04	Injector 2 output open load, short to GND (without resistance), coil open load; IJT2 open/short to GND, EDU malfunction
P1293	Injector 3	01	Injector 3 output short to GND (with resistance), short to battery (injection pulse<0.7ms), coil short; EDU malfunction
		04	Injector 3 output open load, short to GND (without resistance), coil open load; IJT3 open/short to GND, EDU malfunction

DTC	Failure Part	Symptom	Failure Mode
P1294	Injector 4	01	Injector 4 output short to GND (with resistance), short to battery (injection pulse<0.7ms), coil short; EDU malfunction
		04	Injector 4 output open load, short to GND (without resistance), coil open load; IJT4 open/short to GND, EDU malfunction
P1295	Injector 5	01	Injector 5 output short to GND (with resistance), short to battery (injection pulse<0.7ms), coil short; EDU malfunction
		04	Injector 5 output open load, short to GND (without resistance), coil open load; IJT5 open/short to GND, EDU malfunction
P1296	Injector 6	01	Injector 6 output short to GND (with resistance), short to battery (injection pulse<0.7ms), coil short; EDU malfunction
		04	Injector 6 output open load, short to GND (without resistance), coil open load; IJT6 open/short to GND, EDU malfunction
P0200	Injector drive1	00	Injector 1 or 3 or 5 output short to battery (injection pulse>0.7ms), injector 1 or 3 or 5 output short to GND (failure occurred when EDU power off), IJT1 or 3 or 5 output short to battery, IJF1 output short to GND, COM1 open load/short to GND (failure occurred when EDU power off), COM1 short to battery, EDU malfunction
P1200	Injector drive2	00	Injector 2 or 4 or 6 output short to battery (injection pulse>0.7ms), injector 2 or 4 or 6 output short to GND (failure occurred when EDU power off), IJT2 or 4 or 6 output short to battery, IJF2 output short to GND, COM2 open load/short to GND (failure occurred when EDU power off), COM2 short to battery, EDU malfunction
P1216	Injector drive1	1A	IJF1 output open load/short to battery, injector 1 or 3 or 5 output short to GND (failure occurred when EDU power on), COM1 open load/short to GND (failure occurred when EDU power on), EDU malfunction
	Injector drive2	1B	IJF2 output open load/short to battery, injector 2 or 4 or 6 output short to GND (failure occurred when EDU power on), COM2 open load/short to GND (failure occurred when EDU power on), EDU malfunction
	EDU	00	EDU battery open load/short to GND, EDU GND open load/short to battery, EDU malfunction
	Injector/EDU	08	Unknown failure pattern. EDU malfunction
P0602	QR code	52	QR code not programmed
		51	QR code error
		53	QR correction information abnormal
P0251	Pump SCV	01	SCV COM short to battery; SCV1, 2 output short to battery
		06	SCV COM short to GND/open load; SCV1, 2 (COM side) short to GND; unknown SCV failure
		04	SCV1, 2 output open load/short to GND; SCV1, 2 coil open
		0E	SCV1, 2 coil short
P0093	Common rail system	00	Rail pressure sensor performance invalid included fuel leak
P0190	Rail pressure sensor	11	Rail pressure exceeds upper limit
P1190	Rail pressure limiter	00	Pressure limiter activated
P0217	Engine overheat	00	Engine overheat
P0219	Engine overrun	00	Engine overrun

DTC	Failure Part	Symptom	Failure Mode
P0606	Engine ECU internal failure	35	Check sum error-flash area
		30	CPU fault; main CPU fault
		37	CPU fault; watchdog IC fault
P0301	Injector 1	00	Cylinder 1 fuel system failure
P0302	Injector 2	00	Cylinder 2 fuel system failure
P0303	Injector 3	00	Cylinder 3 fuel system failure
P0304	Injector 4	00	Cylinder 4 fuel system failure
P0305	Injector 5	00	Cylinder 5 fuel system failure
P0306	Injector 6	00	Cylinder 6 fuel system failure
P0400	EGR system	11	EGR excessive/insufficient flow (EGR positive deviation)
		12	EGR excessive/insufficient flow (EGR negative deviation)
P0409		63	EGR valve close stuck
P0235	Turbo system	12	Turbo control system (negative deviation)
		11	Turbo control system (positive deviation)
	Turbo unit	70	CAN2 turbo unit absent
		00	Turbo unit failure
P0409	EGR system	62	EGR valve open stuck
P1109	Swirl control position switch	63	Swirl control flap remains closed
P1110		62	Swirl control flap remains open
P1111		63	Swirl control flap remains closed
P1112		62	Swirl control flap remains open
P0403	EGR DC motor	61	EGR DC motor lock
P0425	Upper oxygen catalyst temperature sensor	07	Voltage too high
		03	Voltage too low
		54	Temperature too high
		53	Temperature too low
P1902	Upper DPF catalyst temperature sensor	07	Voltage too high
		03	Voltage too low
		54	Temperature too high
		53	Temperature too low
P1901	Exhaust deferential pressure sensor	07	Voltage too high
		03	Voltage too low
		11	difference pressure too high
		12	Hose line disconnected upstream
P0093	Rail pressure	52	Rail pressure deviation too big
P1481	Fan relay 1 output	01	Fan control relay 1 short to battery
		06	Fan control relay 1 open load/short to GND
P1482	Fan relay 2 output	01	Fan control relay 2 short to battery
		06	Fan control relay 2 open load/short to GND
P1483	Fan relay 3 output	01	Fan control relay 3 short to battery
		06	Fan control relay 3 open load/short to GND

DTC	Failure Part	Symptom	Failure Mode
P1530	A/C relay	01	A/C relay output short to battery
		06	A/C relay output open load/short to GND
P0615	Starter relay	01	Starter relay output short to battery
		06	Starter relay output open load/short to GND
P0501	Vehicle speed	07	Vehicle speed too high
		03	Vehicle speed too low
		08	Vehicle speed too invalid
P0530	A/C pressure	07	A/C pressure sensor signal too high
		03	A/C pressure sensor signal too low
P0460	Fuel level sensor	07	Fuel level sensor signal too high
		03	Fuel level sensor signal too low
P0571	Brake switch	08	Brake switch inactive error when vehicle deceleration (two brake error)
P0704	Clutch switch	00	Clutch switch malfunction
P0520	Oil pressure switch	63	Oil pressure switch stuck closed
		62	Oil pressure switch stuck open
P0650	Check engine warning light	01	Check engine warning light short to battery
		06	Check engine warning light open load/short to GND
P0621	Alternator L-terminal	07	Alternator L-terminal short to battery/open
		03	Alternator L-terminal short to GND, Generator failure
U2103	CAN data error	70	Node error (Bus-off)
U2106		70	Transmission general status frame receive is failed
U2108		70	Antilock brakes general status frame receive is failed
U2139		70	CIM (Column Integrated Module) general frame receive is failed
U2144		70	ACC (Adaptive Cruise Control) general status frame receive is failed
P0700	VIF (Vehicle Integrated Function) related diagnosis	00	Transmission emission related malfunction
P1700		00	Service transmission system
P1035		71	Wheel speed signal set to invalid
P0500		71	Wheel rotation signal set to invalid
P0705		71	TCM (Transmission Control Module) actual gear set to invalid
P1813		72	TCM request torque RC (Rolling Counter) error
P0070		71	Outside air temperature invalid
P1811		72	TRC (Traction Control System) request torque RC error
		74	TRC request torque protection value error
P1602		4D	Vmax (Maximum Vehicle Speed) limitation speed is not programmed
P0217	Engine overheat	54	Fuel quantity reduction by exhaust temperature
P1814	Cruise switch	71	ECC (Electronic Climate Control) torque set to invalid
P1565		71	Cruise control switch invalid
		72	Cruise control switch RC error
		74	Cruise control switch protection value error

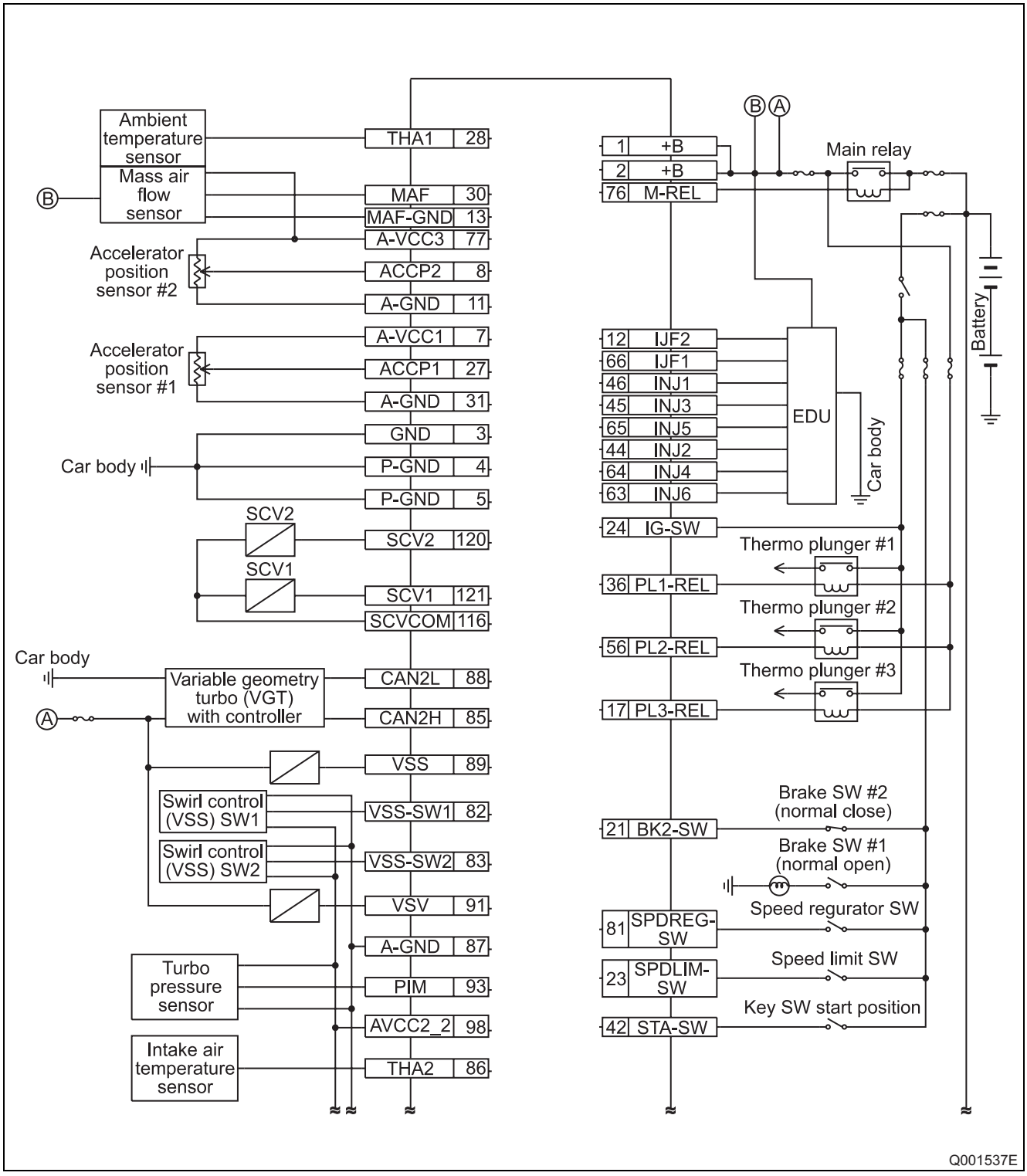
DTC	Failure Part	Symptom	Failure Mode
P1610	Immobilizer	00	ICM3 (Immobilizer 3 Control Unit) function in ECU not programmed, in function reset mode
		4F	ICM3 function in ECU is switched off
P1611		00	Incorrect security code input
P1613		00	Response frame not received
P1614		00	Transmitted response was incorrect
		50	Transmitted response was distorted ("0")
P1615		00	Failed powertrain identification
P1616		00	Failed powertrain identification
P0602	Programming	44	Security access not armed
		47	VIN not programmed
		45	Variant word not programmed
		4A	Tire circumference not programmed
		00	Not programmed
U2101		46	SCL (Subnet Configuration List) is not defined
P0638	Intake throttle valve	63	Intake throttle stuck closed
		62	Intake throttle stuck open
U2112	CAN data error	70	SADS (Semi Active Damping System) frame receive is failed
P1900	DPF system	55	DPF overload
		58	DPF crack
		57	DPF regeneration not complete
		56	DPF overload 2
P1901		0F	Differential pressure sensor characteristic abnormality
P0606		36	EEPROM (Electronically Erasable and Programmable Read Only Memory) failure
P0425		52	Exhaust temperature 1 sensor characteristic abnormality
P1902		52	Exhaust temperature 2 sensor characteristic abnormality
P1480	Fan	01	Fan PWM (Pulse Width Modulation) control line short to battery
		06	Fan PWM control line open load/short to GND
P0235	Turbo	63	Variable nozzle turbo valve stuck closed
		62	Variable nozzle turbo valve stuck open
		50	Turbo unit failure 2
		6F	Variable nozzle turbo hose popping off
P0409	EGR valve	52	EGR lift sensor characteristic abnormality (learning value fault)
P0100	Mass air flow sensor	12	Mass air flow sensor too low
P0530	A/C pressure sensor	02	A/C pressure sensor short to GND
P0403	EGR	54	EGR over temperature
P0235	Popping-off	6F	Variable nozzle turbo hose popping off
P0602	Microinjection quantity learning	4B	Microinjection quantity learning value not programmed
P1604		33	Microinjection quantity learning value error

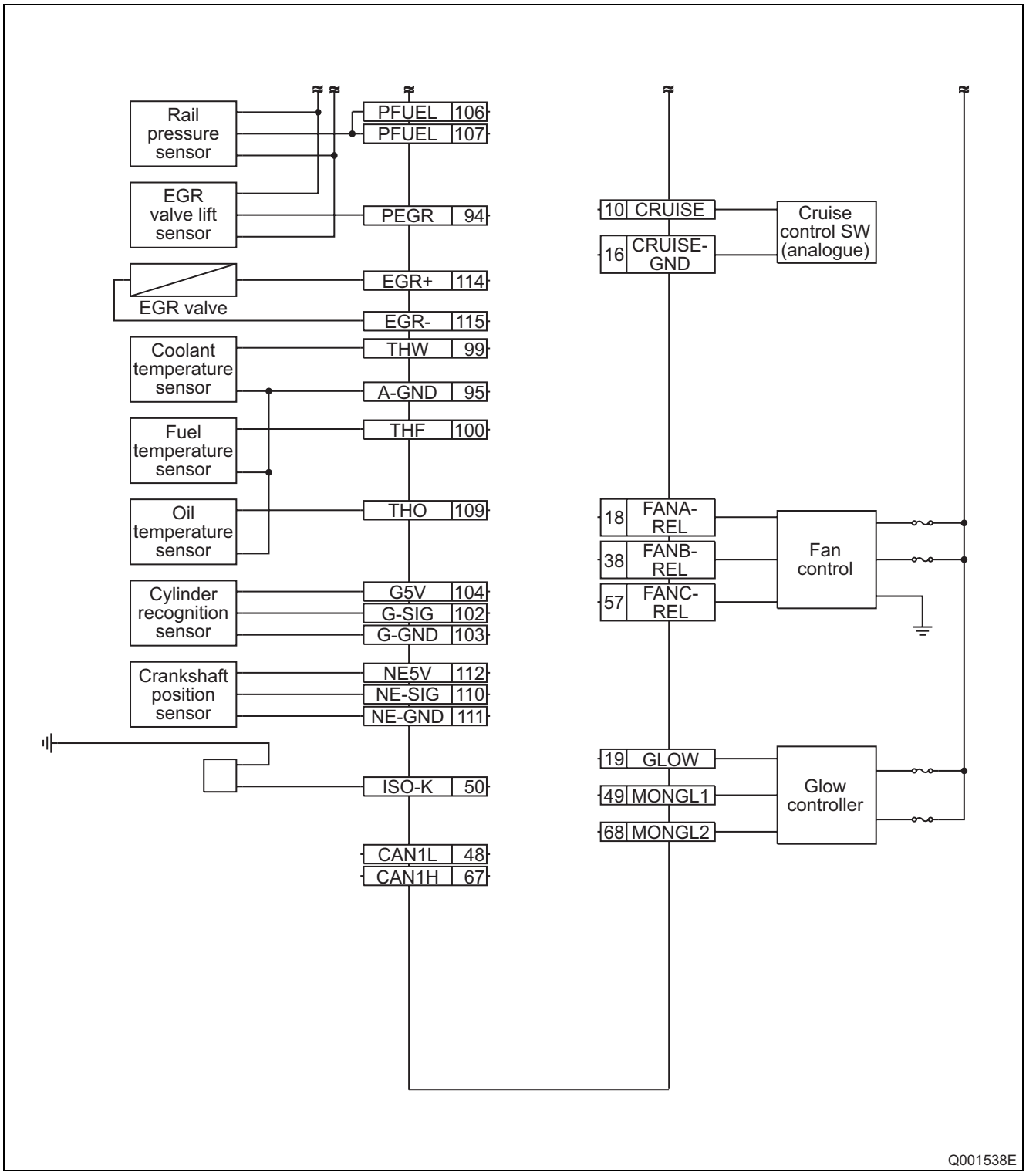
DTC	Failure Part	Symptom	Failure Mode
P0571	Brake switch signal error	01	Brake switch permanently active (two brake error)
		5A	Brake switch sequence error (BLS error)
		56	Brake switch analog voltage error (BLS error)
P1571		04	Brake switch event error (BTS error)

8. EXTERNAL WIRING DIAGRAM

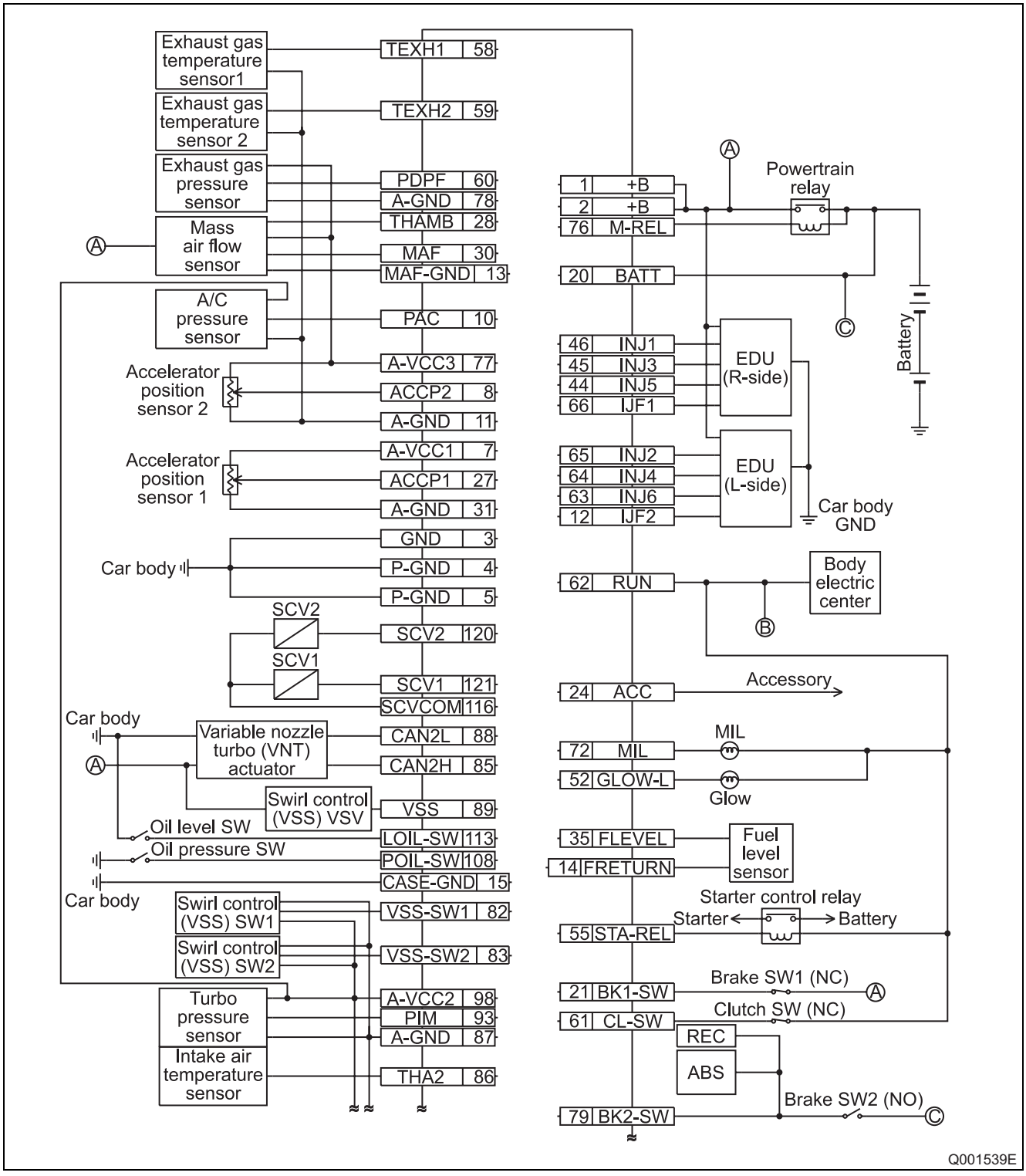
8.1 ECU External Wiring Diagram

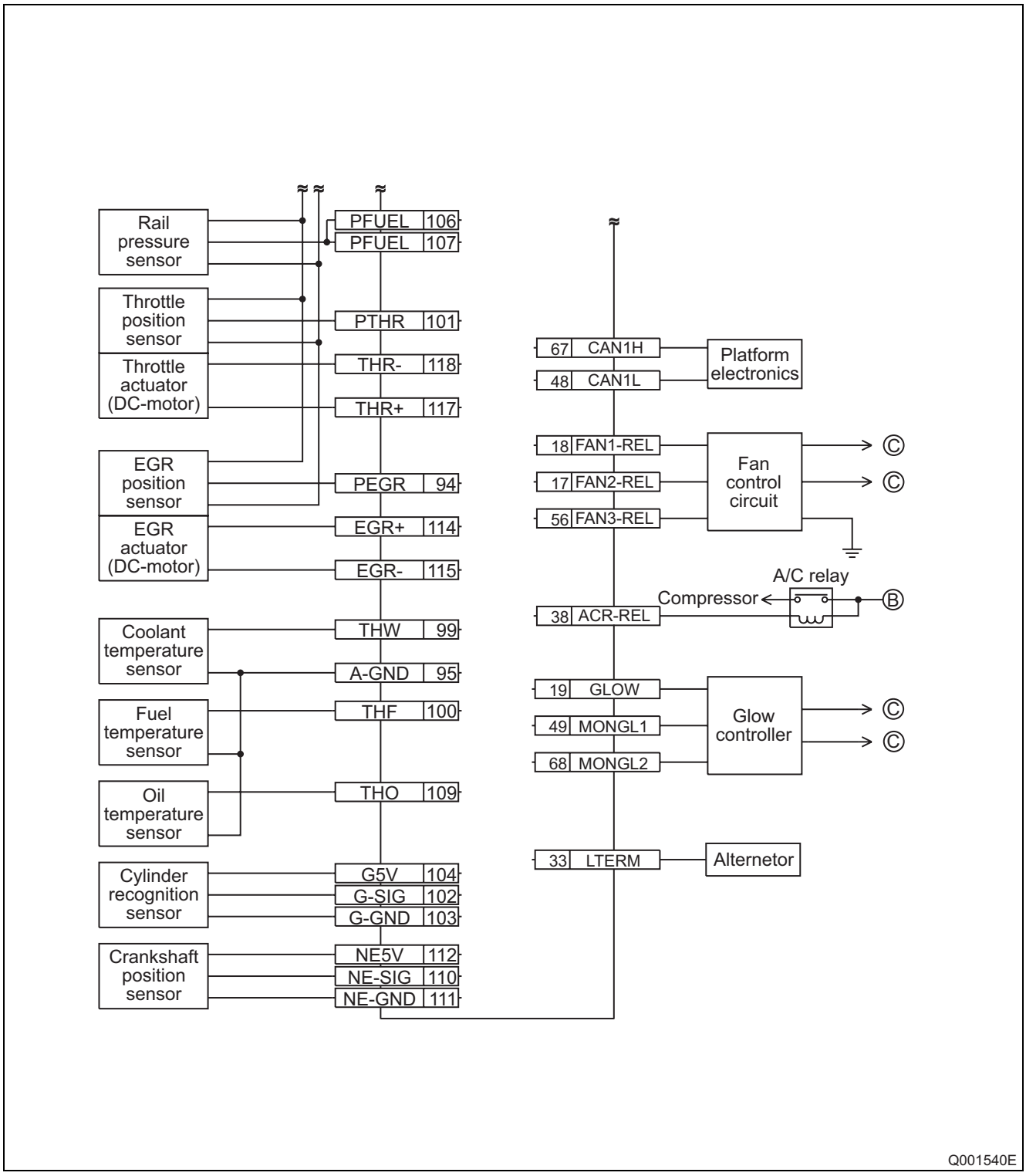
(1) For RENAULT




Rail pressure sensor
EGR valve lift sensor
EGR valve
Coolant temperature sensor
Fuel temperature sensor
Oil temperature sensor
Cylinder recognition sensor
Crankshaft position sensor
PFUEL 106
PFUEL 107
PEGR 94
EGR+ 114
EGR- 115
THW 99
A-GND 95
THF 100
THO 109
G5V 104
G-SIG 102
G-GND 103
NE5V 112
NE-SIG 110
NE-GND 111
ISO-K 50
CAN1L 48
CAN1H 67
10 CRUISE
16 CRUISE-GND
Cruise control SW (analogue)
18 FANA-REL
38 FANB-REL
57 FANC-REL
Fan control
19 GLOW
49 MONGL1
68 MONGL2
Glow controller
Q001538E

(2) For OPEL

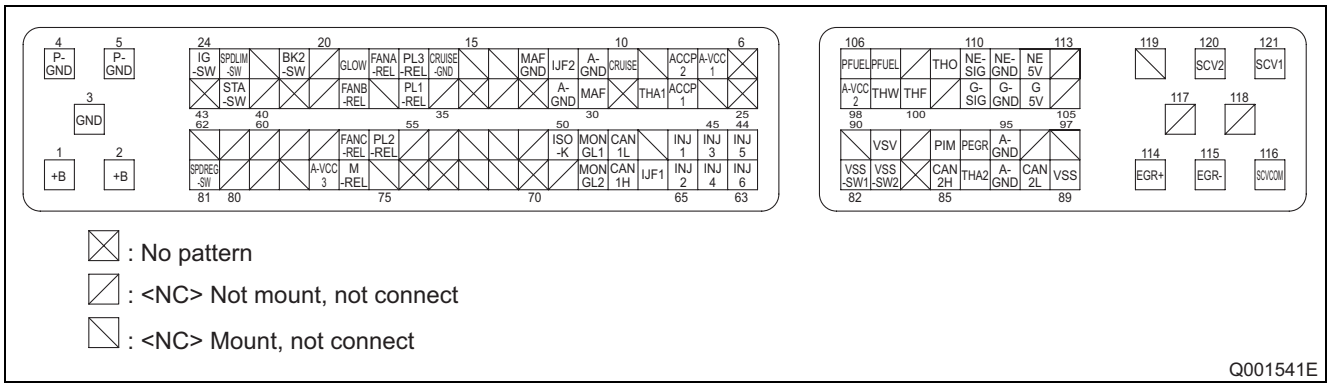

Exhaust gas temperature sensor1
TEXH1 58
Exhaust gas temperature sensor 2
TEXH2 59
Exhaust gas pressure sensor
PDPF 60
A-GND 78
THAMB 28
Mass air flow sensor
MAF 30
MAF-GND 13
A/C pressure sensor
PAC 10
Accelerator position sensor 2
A-VCC3 77
ACCP2 8
A-GND 11
Accelerator position sensor 1
A-VCC1 7
ACCP1 27
A-GND 31
GND 3
Car body
P-GND 4
P-GND 5
SCV2
SCV2 120
SCV1
SCV1 121
SCVCOM 116
Car body
Variable nozzle turbo (VNT) actuator
CAN2L 88
CAN2H 85
Swirl control (VSS) VSV
VSS 89
Oil level SW
LOIL-SW 113
Oil pressure SW
POIL-SW 108
CASE-GND 15
Car body
Swirl control (VSS) SW1
VSS-SW1 82
Swirl control (VSS) SW2
VSS-SW2 83
Turbo pressure sensor
A-VCC2 98
PIM 93
A-GND 87
Intake air temperature sensor
THA2 86
1 +B
2 +B
76 M-REL
Powertrain relay
20 BATT
Battery
46 INJ1
45 INJ3
44 INJ5
66 IJF1
EDU (R-side)
65 INJ2
64 INJ4
63 INJ6
12 IJF2
EDU (L-side)
Car body GND
62 RUN
Body electric center
24 ACC
Accessory
72 MIL
MIL
52 GLOW-L
Glow
35 FLEVEL
14 FRETURN
Fuel level sensor
Starter control relay
55 STA-REL
Starter
Battery
21 BK1-SW
Brake SW1 (NC)
61 CL-SW
Clutch SW (NC)
REC
ABS
79 BK2-SW
Brake SW2 (NO)
Q001539E


Rail pressure sensor
PFUEL 106
PFUEL 107
Throttle position sensor
PTHR 101
Throttle actuator (DC-motor)
THR- 118
THR+ 117
EGR position sensor
PEGR 94
EGR actuator (DC-motor)
EGR+ 114
EGR- 115
Coolant temperature sensor
THW 99
A-GND 95
Fuel temperature sensor
THF 100
Oil temperature sensor
THO 109
Cylinder recognition sensor
G5V 104
G-SIG 102
G-GND 103
Crankshaft position sensor
NE5V 112
NE-SIG 110
NE-GND 111
67 CAN1H
48 CAN1L
Platform electronics
18 FAN1-REL
17 FAN2-REL
56 FAN3-REL
Fan control circuit
Ⓒ
Ⓒ
A/C relay
Compressor
Ⓑ
38 ACR-REL
19 GLOW
49 MONGL1
68 MONGL2
Glow controller
Ⓒ
Ⓒ
33 LTERM
Alternetor
Q001540E

8.2 ECU Connector Diagram

(1) For RENAULT

ECU Connector Pin Layout



: No pattern

: <NC> Not mount, not connect

: <NC> Mount, not connect

Q001541E

Terminal Connections (1)

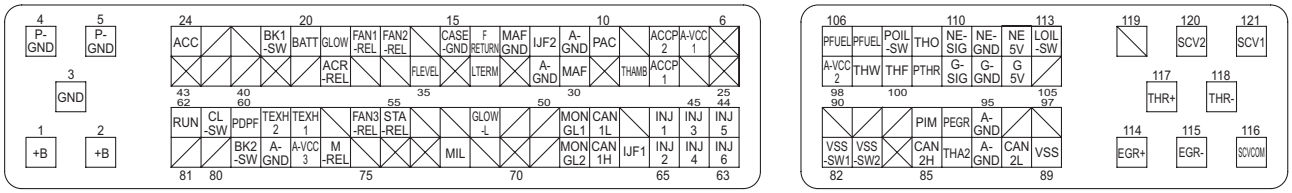
No.	Pin Symbol	Connections	No.	Pin Symbol	Connections
1	+B	+B After	28	THA1	Intake air temperature sensor (SIG)
2	+B	+B After	29		
3	GND	GND	30	MAF	Mass air flow sensor (SIG)
4	P-GND	P-GND	31	A-GND	GND for sensor
5	P-GND	P-GND	32		
6			33		
7	A-VCC1	5V (20mA) For sensors	34		
8	ACCP2	Accelerator position sensor 2 (SIG)	35		
9			36	PL1-REL	Thermo plunger relay 1
10	CRUISE	Cruise SW	37		
11	A-GND	GND for sensors	38	FANB-REL	Fan control relay B
12	IJF2	EDU fail signal 2	39		
13	MAFGND	Mass air flow sensor (GND)	40		
14			41		
15			42	STA-SW	Starter SW
16	CRUISE-GND	GND for cruise control	43		
17	PL3-REL	Thermo plunger relay 3	44	INJ5	Injector drive signal #5
18	FANA-REL	Fan control relay A	45	INJ3	Injector drive signal #3
19	GLOW	Glow controller	46	INJ1	Injector drive signal #1
20			47		
21	BK2-SW	Brake SW2	48	CAN1L	CAN communication (-)
22			49	MONGL1	Glow diagnosis 1
23	SPDLIM-SW	Speed limit SW	50	ISO-K	KW2000 K-Line
24	IG-SW	Ignition SW	51		
25			52		
26			53		
27	ACCP1	Accelerator position sensor 1 (SIG)	54		

Terminal Connections (2)

No.	Pin Symbol	Connections	No.	Pin Symbol	Connections
55			89	VSS	Swirl control
56	PL2-REL	Thermo plunger relay 2	90		
57	FANC-REL	Fan control relay C	91	VSV	Intake shutter
58			92		
59			93	PIM	Turbo pressure sensor (SIG)
60			94	PEGR	EGR lift sensor (SIG)
61			95	A-GND	GND for sensor
62			96		
63	INJ6	Injector drive signal #6	97		
64	INJ4	Injector drive signal #4	98	A-VCC2	5V (100mA) for sensor
65	INJ2	Injector drive signal #2	99	THW	Coolant temperature sensor (SIG)
66	IJF1	EDU fail signal 1	100	THF	Fuel temperature sensor (SIG)
67	CAN1H	CAN communication (+)	101		
68	MONGL2	Glow diagnosis 2	102	G SIG	Cylinder recognition sensor (SIG)
69			103	G GND	Cylinder recognition sensor (GND)
70			104	G +5V	Cylinder recognition sensor (+5V)
71			105		
72			106	PFUEL	Rail pressure sensor (SIG1)
73			107	PFUEL	Rail pressure sensor (SIG2)
74			108		
75			109	THO	Oil temperature sensor
76	M-REL	Coil: main relay	110	NE SIG	Crankshaft position sensor (SIG)
77	A-VCC3	5V (30mA) for sensors	111	NE (GND)	Crankshaft position sensor (GND)
78			112	NE +5V	Crankshaft position sensor (+5V)
79			113		
80			114	EGR+	EGR valve actuator +
81	SPDREG-SW	Speed regulate SW	115	LSEGR	EGR valve actuator -
82	VSS-SW1	Swirl control valve SW1	116	SCVCOM	SCV common
83	VSS-SW2	Swirl control valve SW2	117		
84			118		
85	CAN2-H	Turbo	119		
86	THA2	Intake air temperature sensor (boost)	120	SCV2	SCV2
87	A-GND	GND for sensor	121	SCV1	SCV1
88	CAN2-L	Turbo			

(2) For OPEL

ECU Connector Pin Layout



: No pattern

: <NC> Not mount, not connect

: <NC> Mount, not connect

Q001542E

Terminal Connections (1)

No.	Pin Symbol	Connections	No.	Pin Symbol	Connections
1	+B	+B After	28	THAMB	Ambient temperature sensor
2	+B	+B After	29		
3	GND	GND	30	MAF	Mass air flow sensor (SIG)
4	P-GND	P-GND	31	A-GND	GND for sensor
5	P-GND	P-GND	32		
6			33	LTERM	Alternator L-terminal I/O
7	A-VCC1	5V (20mA) for sensors	34		
8	ACCP2	Accelerator position sensor 2 (SIG)	35	FLEVEL	Fuel level sensor
9			36		
10	PAC	A/C pressure sensor	37		
11	A-GND	GND for sensor	38	ACR-REL	A/C relay
12	IJF2	EDU fail signal 2	39		
13	MAFGND	Mass air flow sensor (GND)	40		
14	FRETURN	Fuel level return	41		
15	CASE GND	ECU case GND	42		
16			43		
17	FAN2-REL	Fan control relay 2	44	INJ5	Injector drive signal #5
18	FAN1-REL	Fan control relay 1	45	INJ3	Injector drive signal #3
19	GLOW	Glow controller	46	INJ1	Injector drive signal #1
20	BATT	Battery	47		
21	BK1-SW	Brake SW1	48	CAN1L	CAN communication (-)
22			49	MONGL1	Glow diagnosis 1
23			50		
24	ACC	Accessory input	51		
25			52	GLOW-L	Glow indicator
26			53		
27	ACCP1	Accelerator position sensor 1 (SIG)	54		

Terminal Connections (2)

No.	Pin Symbol	Connections	No.	Pin Symbol	Connections
55	STA-REL	Starter control relay	89	VSS	Swirl control
56	FAN3-REL	Fan control relay 3	90		
57			91		
58	TEXH1	Exhaust temperature sensor 1	92		
59	TEXH2	Exhaust temperature sensor 2	93	PIM	Turbo pressure sensor (SIG)
60	PDPF	Differential pressure sensor	94	PEGR	EGR lift sensor (SIG)
61	CL-SW	Clutch SW	95	A-GND	GND for sensor
62	RUN	Supply from run/crank relay (IG-SW)	96		
63	INJ6	Injector drive signal #6	97		
64	INJ4	Injector drive signal #4	98	A-VCC2	5V (100mA) for sensor
65	INJ2	Injector drive signal #2	99	THW	Coolant temperature sensor (SIG)
66	IJF1	EDU fail signal 1	100	THF	Fuel temperature sensor (SIG)
67	CAN1H	CAN communication (+)	101	PTHR	Throttle position sensor
68	MONGL2	Glow diagnosis 2	102	G SIG	Cylinder recognition sensor (SIG)
69			103	G GND	Cylinder recognition sensor (GND)
70			104	G5V	Cylinder recognition sensor (+5V)
71			105		
72	MIL	Check engine warning light	106	PFUEL	Rail pressure sensor (SIG1)
73			107	PFUEL	Rail pressure sensor (SIG2)
74			108	POIL-SW	Oil pressure SW
75			109	THO	Oil temperature sensor
76	M-REL	Coil: main relay	110	NE SIG	Crankshaft position sensor (SIG)
77	A-VCC3	5V (30mA) for sensors	111	NE (GND)	Crankshaft position sensor (GND)
78	A-GND	GND for sensor	112	NE5V	Crankshaft position sensor (+5V)
79	BK2-SW	Brake SW2	113	LOIL-SW	Oil level SW
80			114	EGR+	EGR valve actuator +
81			115	LSEGR	EGR valve actuator -
82	VSS-SW1	Swirl control valve SW1	116	SCVCOM	SCVCOM
83	VSS-SW2	Swirl control valve SW2	117	THR+	Throttle actuator +
84			118	THR-	Throttle actuator -
85	CAN2-H	Turbo	119		
86	THA2	Intake air temperature sensor (boost)	120	SCV2	SCV2
87	A-GND	GND for sensor	121	SCV1	SCV1
88	CAN2-L	Turbo			

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